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Geoscientific Model Development Discussions

Interactive comment on "A unified parameterization of clouds and turbulence using CLUBB and subcolumns in the Community Atmosphere Model" *by* K. Thayer-Calder et al.

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I would like to contribute few comments:

• Introduction: Needs for overcoming the current custom of using separate equation set for each parameterization:

It would be helpful to refer to some of the previous proposals and efforts here. Yano *et al.* (2005) emphasize an importance of developing a suite of subgrid–scale parameterizations starting from a single set of equation system. More specifically, they propose a mode decomposition as such a general principle enabling a consistent de-

velopment of subgrid–scale parameterizations (see also Yano *et al.* 2014). A series of work by Moncrieff and colleagues (Moncrieff and Green 1972; Moncrieff and Miller 1976; Moncrieff 1978, 1981 1992; Thorpe *et al.* 1982; Moncrieff and So 1989) may be considered a more solid effort for developing a parameterization specifically for mesoscale convection organization from a first principle of the vorticity conservation. So long as I understand, the present series of studies makes an equivalent effort by invoking the subgrid-scale distribution of variables (probability density function, PDF) as a general guiding principle. This point could be better emphasized in the manuscript.

• Introduction: Importance of subgrid coupling between clouds and microphysics:

Here, Hohenegger and Bretherton (2011) would probably not be the best reference to make this point. Though they indeed invoke the precipitation rate as an input variable for defining the entrainment–detrainment rate, this is more as a crude measure of the cold pool strength in the boundary layer not directly available in the given convection parameterization. Importance of coupling between convection and mircophysics is better discussed, for example, by Emanuel (1991) and Donner (1993) in their parameterization studies.

• Methodology:

The presentation of the methodology is rather terse, and it can be expanded. I would like to see a better–presented overview of the methodology. So long as I understood there is an interplay of calculations within the PDF and physical spaces. What processes are evaluated in the PDF and physical spaces, respectively? A flow chart for calculation steps could be helpful for getting an overall picture clearer, too. It would also be helpful to know how convection (*i.e.*, Zhang and McFarlane scheme) is coupled with CLUBB.

references

Donner, L. J., 1993: A cumulus parameterization including mass fluxes, vertical mo-

mentum dynamics, and mesoscale effects. *J. Atmos. Sci.*, **50**, 889–906.

Emanuel, K. A., 1991: A scheme for representing cumulus convection in large-scale models, *J. Atmos. Sci.*, **48**, 2313–2335.

Hohenegger, C. and Bretherton, C. S., 2011: Simulating deep convection with a shallow convection scheme, *Atmos. Chem. Phys.*, **11**, 10389–10406,

doi: http://dx.doi.org/10.5194/acp-11-10389-201110.5194/acp-11-10389-2011.

Moncrieff, M. W., 1978: The dynamical structure of two–dimensional steady convection in constant vertical shear. *Quart. J. Roy. Meteor. Soc.*, **104**, 543–567.

Moncrieff, M. W., 1981: A theory of organized steady convection and its properties. *Quart. J. Roy. Meteor. Soc.*, **107**, 29–50.

Moncrieff, M. W., 1992: Organized convective systems: Archetypal dynamical models, mass and momentum flux theory, and parametrization, *Quart. J. Roy. Meteorol. Soc.*, **118**, 819—850.

Moncrieff M. W.,and J. S. A. Green, 1972: The propagation and transfer properties of steady convective overturning in shear. *Quart. J. Roy. Meteor. Soc.*, **98**, 336–352.

Moncrieff M. W.,and M. J. Miller, 1976: The dynamics and simulation of tropical cumulonimbus and squall lines. *Quart. J. Roy. Meteor. Soc.*, **102**, 373–394.

Moncrieff M. W.,and D. W. K. So, 1989: A hydrodynamical theory of conservative bounded density currents. *J. Fluid Mech.*, **198**, 177–197.

Thorpe, A. J., M. J. Miller, and M. W. Moncrieff, 1982: Two–dimensional convection in non–constant shear: A model of mid–latitude squall lines. *Quart. J. Roy. Meteor. Soc.*, **108**, 739–762.

Yano, J.-I., J.-L. Redelsperger, F. Guichard, and P. Bechtold, 2005: Mode Decomposition As a Methodology For Developing Convective-Scale Representations in Global

Models. *Quator. J. Roy. Meteor. Soc*, **131**, 2313–2336.

Yano, J.-I., J.-F. Geleyn, M. Köhler, D. Mironov, J. Quaas, P. M. M. Soares, V. T. J. Phillips, R. S. Plant, A. Deluca, P. Marquet, L Stulic, Z. Fuchs, 2014: Basic Concepts for Convection Parameterization in Weather Forecast and Climate Models : COST Action ES0905 Final Report. *Atmosphere*, **6**, 88–147. http://www.mdpi.com/2073-4433/6/1/88/

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